Preventable mortality among sexual minority Canadians

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ABSTRACT

Background: Epidemiologic studies point to multiple health inequities among sexual minority people, but few studies have examined mortality. Some causes of death are more preventable than others, and access to prevention is theorized to follow patterns of access to social and material resources. The objective of this study is to compare estimates of preventable mortality between sexual minority (SM)—i.e., bisexual, lesbian, gay—and heterosexual adults in Canada.

Methods: A population-based retrospective cohort with 442,260 (unweighted N) Canadian adults, ages 18–59 years, was drawn from the Canadian Community Health Survey/Canadian Mortality Database linked database (2003–2017). The Rutstein preventability rating index was used to classify cause-specific mortality (low/high). Longitudinal analyses were conducted using Cox proportional hazards models.

Results: SM respondents had higher hazard of all-cause mortality (unadjusted hazard ratio [uHR] 1.28, 95% CI 1.06, 1.55). The uHR increased when the outcome was limited to highly-preventable causes of mortality (uHR 1.43, 95% CI 1.14, 1.80). The uHR further increased in sensitivity analyses using higher thresholds of the Rutstein index. SM respondents had higher hazard of cause-specific mortality for heart disease (uHR 1.53, 95% CI 1.03, 2.29), accidents (uHR 1.97, 95% CI 1.01, 3.86), HIV (uHR 75.69, 95% CI 18.77, 305.20), and suicide (uHR 2.22, 95% CI 0.93, 5.30) but not for cancer (uHR 0.86, 95% CI 0.60, 1.25). The adjusted HR (aHR) for highly-preventable mortality was not attenuated by adjustment for confounders (aHR 1.57, 95% CI 1.20, 2.05) but was reduced by adjustment for hypothesized mediators relating to access to social and material resources (marital status, children, income, education; aHR 1.11, 95% CI 0.78, 1.58).

Conclusions: Preventable mortality was elevated for SM Canadians compared to heterosexuals. Early and broad access to sexual minority-affirming primary and preventive healthcare should be expanded.

1. Introduction

International empirical studies have consistently demonstrated substantial health and behavioral inequities among sexual minority populations (e.g., lesbian, gay, and bisexual people) relative to heterosexual populations. For example, sexual minorities experience two-fold

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or greater risk of inter-personal violence, depression, anxiety, suicide ideation and attempts, sexually transmitted infections, HIV/AIDS, and some forms of substance use (Goldbach et al., 2014; Hottes et al., 2016; Katz-Wise & Hyde, 2012; Purcell et al., 2012; Ross et al., 2018). Evidence for inequities in other health outcomes—particularly those related to chronic physical illnesses (e.g., cancer, cardiovascular disease, asthma, and diabetes)—is scant but emerging (Caceres et al., 2017; Lick et al., 2013; Meads et al., 2018). A small number of international studies have extended these epidemiological inquiries to examine differences in mortality between sexual minority and heterosexual groups, finding elevated all-cause mortality and HIV-related mortality among sexual minority men in one US study (Cochran & Mays, 2011) and elevated suicide mortality among sexual minority adults in the US (Cochran & Mays, 2015), Denmark (Mathy et al., 2011), and Sweden (Bjorkenstam et al., 2016).

A range of structural, social, psychological, physiological, and behavioral causal pathways warrant investigation as explanations for sexual minority health inequities (Krieger, 2020). Many of these pathways start with what has been termed a "minority stress" process (Brooks, 1981; Meyer, 2003). Sexual minority stress theory predicts that an accumulation of enacted and perceived external threats to sexual minorities (e.g., violence, discrimination, social exclusion) as well as internalized notions of shame and sexual identity concealment will lead to psychological, physiological, and behavioral responses that in turn cause disease-specific processes (Hatzenbuehler, 2009). To-date, minority stress causal pathways have predominantly been conceptualized as direct effects of these particular stressors (violence, discrimination, internalized shame, concealment, etc.) on the psychopathology or physiology of disease; in other words, the accumulation of minority stress directly causes production of disease (Hatzenbuehler, 2009; Juster et al., 2015). Brooks's sexual minority stress model (1981), however, additionally includes a socio-economic domain, suggesting that other indirect pathways are important in explaining at least some portion of the elevated burden of multiple diseases in sexual minority populations (Brooks, 1981; Rich et al., 2020).

Fundamental cause theory, which has been used to explain health disparities associated with socioeconomic status (Link & Phelan, 1995), therefore may be complementary to this broader notion of sexual minority stress theory. In their paper introducing stigma as a fundamental cause in its own right, Hatzenbuehler et al. posit that the mediators between sexual minority stigma and poor health will include, not only stress and related psychological and behavioral responses, but also differential access to material and social resources (Hatzenbuehler et al., 2013). These resources include factors that are 'proximal' to health outcomes of interest—i.e., those affecting access to preventative healthcare or early diagnosis and treatment—and factors that are 'distal' but even more fundamental to the daily lives of sexual minorities—i.e., immediate family supports (spouses/partners, children), employment, income, etc.

In the case of 'proximal' resources, because of minority stress, many sexual minorities perceive or anticipate healthcare providers to be stigmatizing with regard to their minority sexual orientation, or have experienced this firsthand, and therefore delay or avoid healthcare encounters (Neville & Henrickson, 2006). Consequently, sexual minorities are more likely than heterosexuals to report unmet health needs or barriers to accessing health services (Tjepkema, 2008). This suggests that an additional pathway between minority stress and poor health includes missed or delayed opportunities for early preventive interventions through the healthcare system (Bränström et al., 2016).

Differential access to 'distal' social (e.g., family members, support networks) and material (e.g., income) resources have been less frequently studied as mediators of sexual orientation and health outcome disparities (Bränström et al., 2019). These factors may be relevant to understanding sexual minority health, given that sexual minorities may experience differences in access to social resources due to lower rates of marriage/partnership (Bränström et al., 2016); lower

rates of childrearing (and thus differential access to social networks associated with parenting/schools) (Bränström et al., 2019); differences in size, range, and density of social networks (Erosheva et al., 2016); and, lower levels of community belonging or trust (Bränström et al., 2019). Sexual minorities may additionally experience lower levels of access to material resources owing to their lower levels of income relative to heterosexuals (Badgett et al., 2013). Consistent with fundamental cause theory, a recent Swedish study found that four societal barriers to social integration, including not being married/partnered, not living with children, being unemployed, and lack of societal trust, mediated approximately 30% of the disparity in elevated suicide-related outcomes among sexual minority compared to heterosexual Swedes (Bränström et al., 2019). If these distal factors are important in explaining sexual minority health inequities, then structural solutions—focusing on systemic improvements in social resources, employment/workplace equity, familial/reproductive justice—may be warranted.

The objective of this study is to apply fundamental cause theory (Hatzenbuehler et al., 2013) to sexual minority health by estimating and comparing rates of preventable mortality among sexual minority and heterosexual respondents in a large representative sample of Canadians derived from the Canadian Community Health Survey. We used fundamental cause theory—and methods previously established by Phelan et al. (Phelan et al., 2004)—to test two hypotheses. First, we hypothesized that sexual orientation disparities in mortality would be greater in magnitude for specific causes of death that are preventable "by means of medical treatment or other interventions administered after the disease [has] been detected" or "by preventing the incidence of the disease—for example by good hygiene, diet, other lifestyle factors, vaccines, etc." (Phelan et al., 2004) This is because highly-preventable causes of death are more amenable to prevention through access to social and material resources, including greater or more timely access to healthcare. Second, we hypothesized that the association between sexual orientation and preventable mortality would be mediated by one or more variables corresponding to social and material resources.

2. Methods

2.1. Data

The Canadian Community Health Survey and Canadian Mortality Database (CCHS-CMDB) is a retrospective cohort of Canadians, sampled from the CCHS between 2000 and 2017 and followed for record of death until December 31, 2017 (Sanmartin et al., 2016). CCHS is a serial cross-sectional study, and nationally representative of approximately 97% of the non-institutionalized Canadian population aged 12 or over. CCHS respondents who consented to share their personal health numbers for the purposes of data linkage (approximately 85% of all survey participants) were probabilistically linked to the Historical Tax Summary File—in order to identify alternative postal codes and names—then to the CMDB, using name, date of birth, sex, and postal code; additional details are reported elsewhere (Sanmartin et al., 2016). Access to the CCHS-CMDB was obtained through the Canadian Research Data Centre Network. Data collection and linkage were approved by Statistics Canada's Executive Management Board (ref. num. 003–2015); access and privacy standards are governed by Statistics Canada's Directive on Record Linkage, and ethical standards were met through compliance with the federal *Statistics Act* (Sanmartin et al., 2016). The CCHS-CMDB is reproduced and distributed on an "as is" basis with the permission of Statistics Canada.

2.2. Variables

Sexual orientation was assessed using a single identity-based measure, "Do you consider yourself to be: heterosexual (sexual relations with people of the opposite sex), homosexual, that is lesbian or gay

(sexual relations with people of your own sex), bisexual (sexual relations with people of both sexes)?" This question was introduced in 2003 and subsequently asked of adults 18–59 years of age until 2012, after which it was asked of all respondents age 15 years and older.

We updated the Rutstein preventability rating index for the 96 most common causes of death (in the US National Death Index, 1990), and supplemented these with any other causes of death that appeared in >5 records in the CCHS-CMDB (Phelan et al., 2004; Rutstein et al., 1976). The Rutstein index has been previously used in numerous epidemiologic analyses of "health events whose occurrence should provide an alarm that something was awry in the delivery of health care," due to the preventable nature of the outcomes (Phelan et al., 2004; Rutstein et al., 1976), and most recently has been used to analyze preventable causes of hospitalization among sexual minorities in Sweden (Bränström et al., 2016). Three physicians (coauthors: AS, SK, TG) independently rated each cause of death, coded according to the International Classification of Diseases, 10th revision (ICD-10), in 0.5-point increments on a scale from 1 ("virtually impossible to prevent death") to 5 ("virtually all deaths preventable"). Preventability was defined using two criteria, consistent with the Phelan et al. application of the Rutstein index: 1) "the degree to which that cause of death was preventable by preventing the incidence of the disease—for example, by good hygiene, diet, other lifestyle factors, vaccines, etc." (i.e., primary preventability), and 2) "the degree to which that cause of death was preventable by means of medical treatment or other interventions administered after the disease had been detected" (i.e., tertiary preventability) (Phelan et al., 2004). Raters were instructed to consider preventability in the context of the contemporary Canadian medical system. A rating was assigned for each ICD-10 code by considering both criteria in concert (i.e., a cause could be classified as highly preventable either if disease incidence was highly preventable through primary prevention strategies, or if, once diagnosed, disease mortality was highly preventable through treatment).

An interrater composite rating was calculated by taking the mean of the intra-rater composite ratings. As defined by Phelan et al. we classified those causes of death with ratings ≥4.0 as "high-preventable" and those with ratings <4.0 as "low-preventable." We flagged any causes with an inter-rater composite rating between 3.5 and 4.5 for which any two raters provided ratings that differed by ≥ 0.5. The raters then met with the first author to arrive at a consensus rating for these flagged discrepancies (11/144). Among the analytic sample with any death

record in the CMDB, 88.1% were assigned a preventability rating. 84 of the 144 (58%) ICD-10 codes were classified as highly-preventable using the ≥4.0 threshold. The mean (k = 3) intraclass correlation coefficient was 0.90 (95% confidence interval [CI] 0.85, 0.94), indicating good interrater reliability. A full list of the ICD-10 codes and their interrater composite ratings are presented in Appendix A.

We used a directed acyclic graph to identify hypothesized mediators and confounders of the association between sexual minority status and preventable mortality (Fig. 1). Race, gender/sex, age, and urban residence were theorized as unlikely to be affected by sexual minority status but are known to be causes of both sexual minority status disclosure (Ferlatte et al., 2017) and premature mortality (Frohlich et al., 2006; Sanmartin et al., 2016), and therefore constitute confounding variables. We conceived of race and gender/sex, not as biologically deterministic factors, but rather as constructs that reflect pervasive and inequitable social differences in experiences of oppression and access to material resources (Neophytou et al., 2021). Marital status (previously married; single; married/partnered), presence of children (any; none), household income (by quintiles), and educational attainment (less than secondary degree; secondary degree; some postsecondary; postsecondary graduate) were hypothesized to be mediating factors, consistent with fundamental cause theory (Bränström et al., 2019; Link & Phelan, 1995; Tjepkema et al., 2013). These four factors are conceptually distinct from the confounding variables in that that they predominantly occur during adult phases of the life course and hence are more likely to temporally follow the adoption of a sexual minority identity. That is, sexual minority status and its related social conditions were hypothesized to reduce the likelihood of being married/partnered, having children, having a higher household income, and attaining a higher level of education, and these factors, in turn, are fundamental causes of premature mortality (Phelan et al., 2004).

2.3. Analyses

The dataset was restricted to adults 18–59 years of age who provided a valid answer to the sexual orientation question (2003–2017; unweighted N = 442,260). Analyses were conducted in five steps. First, we described the distributions of hypothesized mediators and confounders between sexual minorities and heterosexuals. We additionally examined the distributions of self-rated mental and physical health between sexual
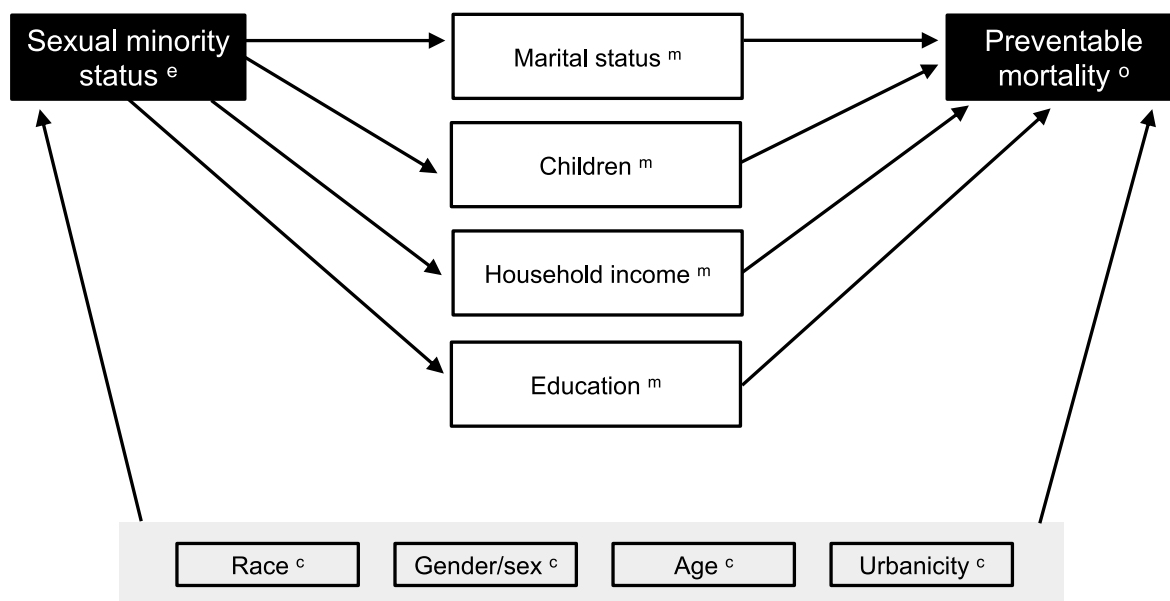

Fig. 1. Conceptual and analytical model of hypothesized causal pathways between sexual minority status and preventable mortality, based on fundamental cause theory (Link and Phelan, 1995); [e] explanatory variable; [o] outcome; [m] mediator; [c] confounder.

minorities and heterosexuals—not as explanatory variables, but rather as secondary outcomes of potential interest (and representing convergent validity with mortality outcomes). Second, we used Cox proportional hazards regression to generate hazard ratios, with 95% confidence intervals (CI), comparing sexual minorities to heterosexuals for the following outcomes: a) the three most common causes of death in the general population (cancer, heart disease, accidents), b) two common causes of premature mortality among sexual minorities (suicide, HIV) (Hottes et al., 2015), c) preventable mortality (Rutstein rating ≥4.0), and d) all-cause mortality. Third, we conducted sensitivity analyses, varying the cut point defining high-preventability between 3.5 and 5.0. Fourth, we evaluated the degree to which any observed association between sexual minority status and preventable mortality was explained by hypothesized confounders (multivariable model 1) and mediators (multivariable models 2–6), by entering these variables sequentially into Cox proportional hazards models. Evidence of confounding or mediation was determined by changes in the magnitude and statistical significance of the hazard ratio (HR) comparing sexual minorities to heterosexuals. Fifth, we conducted additional unadjusted Cox proportional hazards models to estimate HRs for preventable mortality (Rutstein rating ≥4.0), stratified by gender/sex, and comparing bisexual and lesbian/gay groups to heterosexuals, separately (sample size did not support analyses further stratified by sexual orientation identity and gender/sex). All analyses used weights to account for the complex survey design and were conducted in R version 4.0.2.

3. Results

Ninety-seven percent (97.6%) of the CCHS-CMD cohort identified as heterosexual, 1.1% as bisexual, and 1.3% as lesbian/gay. As compared with heterosexuals, a greater proportion of sexual minorities lived in urban areas, were <30 years of age, were women, were un-married/partnered, had no children in the household, and had a household income in the lowest quintile. Fair/poor mental health and physical health were more frequent among sexual minorities (Table 1).

Sexual minorities had significantly greater hazard of all-cause mortality (unadjusted HR [uHR] 1.28, 95% CI 1.06, 1.55), compared with heterosexuals. Statistically significant differences in cause-specific mortality were observed for HIV (uHR 75.69, 95% CI 18.77, 305.20), accidents (uHR 1.97, 95% CI 1.01, 3.86), and heart disease (uHR 1.53, 95% CI 1.03, 2.29). Sexual minorities also had greater hazard of death by suicide, however, the association was not statistically significant (uHR 2.22, 95% CI 0.93, 5.30). No statistically significant difference was observed for cancer mortality (uHR 0.86, 95% CI 0.60, 1.25). (Table 2).

In primary analyses of high-preventable mortality (≥4.0), the uHR for sexual minority status was 1.43 (95% CI 1.14, 1.80), while for low-preventable mortality (<4.0), the uHR was closer to the null and not statistically significant (1.02, 95% CI 0.69, 1.52). In sensitivity analyses, the uHR for high-preventable mortality increased with higher thresholds of the Rutstein rating (i.e., uHR = 1.39 at threshold of ≥3.5, 1.43 at ≥4.0, 1.55 at ≥4.5, and 1.68 at ≥5.0) (Appendix B). Kaplan-Meier survival curves stratified by sexual orientation and preventability of death were overlapping between sexual minority and heterosexual groups in the case of highly preventable deaths but divergent in the case of low-preventable deaths (Fig. 2).

The highly-preventable mortality HR for sexual minority status increased with adjustment for confounders to 1.57 (95% CI 1.20, 2.05). Individual adjustment for two of the mediators (marital status and income) resulted in reductions in the highly-preventable adjusted mortality HR (aHR) such that they were no longer statistically significant (aHR 1.20, 95% CI 0.94, 1.54 for marital status; aHR 1.21, 95% CI 0.89, 1.65 for income). Individual adjustment for the other two mediators (children and educational attainment) did not reduce the highly-preventable aHR. Adjustment for all four mediators (and confounders) further reduced the highly-preventable aHR to 1.11 (95% CI 0.78, 1.58). (Table 3).

Table 1

Characteristics of sexual minority and heterosexual respondents to the Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017 (unweighted N = 442,260).

Characteristic	Level	Sexual minorities	Heterosexuals
Socio-demographics			
Area of residence	Urban	82.6%	73.9%
	Rural	17.4%	26.1%
Age[a]	18–30	34.2%	23.7%
	30–39	21.0%	23.9%
	40–49	22.8%	22.9%
	50–59	22.4%	29.5%
Gender/sex	Women	58.4%	41.6%
	Men	41.6%	58.4%
Race or cultural group[b]	Indigenous	7.8%	5.5%
	White/European	84.5%	85.7%
	Other racialized minority	7.3%	8.8%
Educational attainment	< Secondary	8.2%	8.7%
	Secondary	16.4%	16.1%
	Some postsecondary	21.5%	16.6%
	Postsecondary grad	53.4%	58.6%
Marital status	Married or common-law	31.5%	59.4%
	Previously married	10.5%	12.6%
	Single	58.0%	28.0%
Children in household	None	78.1%	61.8%
	Any	21.5%	38.2%
Household income	Lowest quintile	26.0%	16.2%
	Second-lowest quintile	18.3%	16.1%
	Middle quintile	19.6%	19.4%
	Second-highest quintile	20.1%	22.3%
	Highest quintile	21.5%	25.9%
Health outcomes			
Self-rated physical health	Fair/poor	16.0%	10.5%
Self-rated mental health	Fair/poor	16.0%	6.7%
Person-years of follow-up	Median:	6.65	8.33

Note. All percentages are calculated using weighted estimates.
‡ assessed in the last 12 months.
[a] sexual orientation question only asked of respondents 18–59 years of age in some survey cycles.
[b] persons living on-reserve are not sampled in CCHS.

4. Discussion

Using a large retrospective cohort, we identified an elevated rate of preventable mortality among sexual minority Canadians, relative to heterosexual Canadians (Table 3). This association was specific to causes of death classified as highly preventable, increased with greater specificity of outcome (i.e., higher preventability rating), and did not attenuate with adjustment for hypothesized confounders. These observations strengthen our inference that the effect is not distorted by confounding or misclassification of the outcome. The observed sexual orientation disparity in preventable mortality occurred in the context of a publicly funded medical system in Canada—an iteration of what has been described elsewhere as the inequality paradox associated with whole-population approaches to healthcare (Frohlich & Potvin, 2008). This suggests that additional *tailored* policy and practice interventions are needed to enable equitable preventive care for sexual minorities.

Consistent with a recent study from Sweden (Bränström et al., 2019)—and informed by fundamental cause theory—we found evidence that the association between sexual minority status and preventable mortality is at least partially mediated by two variables that can be conceived as barriers to access to social and material resources: being un-married/unpartnered and having lower levels of household income. Partnership affords access to social resources that may be beneficial in

Table 2

Unadjusted mortality rates and Cox proportional hazard ratios (HR) for all-cause and cause-specific mortality by sexual minority status, Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017

Cause of death	Sexual minorities Rate per 100,000 person-years	Heterosexuals Rate per 100,000 person-years	UHR (95% CI)
Common causes of death, general population			
Cancer	129.62	142.97	0.86 (0.60, 1.25)
Heart disease	64.81	48.58	1.53 (1.03, 2.29)
Accidents	64.81	18.05	1.97 (1.01, 3.86)
Common causes of death, sexual minorities			
Suicide	64.81	15.27	2.22 (0.93, 5.30)
HIV [a]	–	–	75.69 (18.77, 305.20)
All-cause mortality	388.85	317.87	1.28 (1.06, 1.55)

Note. UHR = unadjusted hazard ratio (unadjusted), comparing rate in sexual minorities to rate in heterosexuals.

[a] mortality estimates do not meet Statistics Canada requirements for data release.
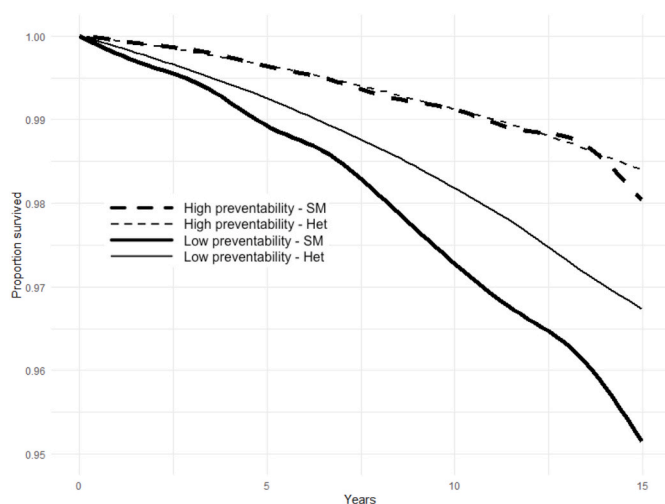

Fig. 2. Cumulative survival by sexual orientation and preventability of death (≥4.0 vs. <4.0), Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017 (Kaplan-Meier curve); Note. SM = sexual minority; Het = heterosexual.

preventing both the onset of some illnesses and ensuring early access to diagnosis and treatment for diseases with preventable mortality (Kim et al., 2017). Relational accountability and reciprocity with partners offer intimate bonds that have health-promoting effects of their own; moreover, partners act as conduits to increase the size of social networks (e.g., through a partner's group of friends, family, or coworkers, or through other parents at a child's school). (Berkman et al., 2000).

Sexual minorities have lower levels of individual income than heterosexuals, and women partnered with women have lower levels of household income than women partnered with men (Badgett et al., 2013). Income is a fundamental driver of multiple health outcomes—determining where one lives, access to prevention tools (healthy diet, exercise), social connections that enable early/timely healthcare—and those living in poverty are less likely to have resources (money, time, power, privilege, control) "that can then be used to avoid risks or minimize the consequences of disease once it occurs." (Link & Phelan, 1995) Particularly relevant to the second criterion of

preventable mortality—i.e., preventable through early medical intervention—Canadians living in poverty are more likely to report unmet healthcare needs, possibly signaling a deficit in opportunities for receiving preventative medical care early in the course of disease (Sibley & Glazier, 2009).

These analyses are limited by several methodological problems inherent to the CCHS dataset. First, sexual orientation was only assessed for Canadians under 60 years of age until recent cycles of the CCHS; thus, we are unable to derive estimates of preventable mortality for older adults. Second, sexual orientation is assessed through an interviewer (in person or by phone), and thus is susceptible to misclassification (underreporting) by up to 33%, due to the stigma attached to sexual minority status (Ferlatte et al., 2017). Assuming nondifferential misclassification, this error likely attenuated the associations in this study by misclassifying sexual minority respondents (with higher mortality) as heterosexuals. In addition, our analyses lacked the specificity to understand the precise pathways between sexual orientation and premature and preventable mortality. We have assumed that some mediators—partnership, children, income, education—are drivers of access to social and material resources; however, further research is needed to explore these pathways in more detail. This is particularly important given that the pathways may be different for sexual minorities relative to what we know based on research with predominantly heterosexuals. For example, while more education may provide access to resources, it may also be associated with exposure to discrimination. Access to these resources also may differ by specific sexual orientations (gay/lesbian, bisexual, etc.) and by gender. Unfortunately, we did not have sufficient sample size to test for moderation of observed associations by sexual orientation (disaggregating bisexual and monosexual identities) and gender using multivariable adjustment of confounders and mediators; however, these sub-group multivariable analyses will be feasible with future updates to the CCHS-CMDB, enlarging the available sample size. Likewise, because Statistics Canada has only recently begun to include gender identity ascertainment measures, we are unable to stratify by gender modality (trans, cis). We included all forms of cancer in the estimate of cancer mortality; however, some types of cancer are more preventable than others. This lack of specificity in the outcome may explain our failure to detect a difference between groups. While we used multiple raters to arrive at our preventability ratings, we encourage further validation and refinements of the categorization scheme we present. Finally, we lacked the sample size to estimate rates of cause-specific mortality with precision for the sexual minority sub-cohort of the CCHS (e.g., for suicide mortality, Table 2). As the CCHS-CMDB cohort is updated with more recent CCHS cycles, more precise estimates may be derived.

Our study offers important implications for public health research and practice. With regard to research on the causes of ill health among sexual minorities, we suggest that social and material resources should be considered alongside minority stress as potential pathways contributing to ongoing sexual orientation inequities in health. Indeed, constrained economic opportunities was included as an important factor in Brooks's, 1981 articulation of minority stress theory, and this socio-structural category of mediators should be evaluated alongside the psychological mediators in future sexual minority epidemiologic studies (Brooks, 1981; Rich et al., 2020). With regard to practice, early and broad access to sexual minority-affirming primary and preventive healthcare should be expanded. Ultimately, the healthcare system should be supported by universal measures to ensure that healthcare encounters affirm the experiences of sexual minorities and thus encourage and support access (Neville & Henrickson, 2006). In the meantime, a tailored approach may be required, which supports low-barrier and affirming clinics that specialize in healthcare delivery for sexual minority populations (Mayer et al., 2012).

Finally, our results suggest that higher level structural interventions may be needed to mitigate inequities in fundamental cause-related mediating factors; historically, these have included non-discrimination

Table 3

Cox proportional hazard ratios (HR) for high -preventable mortality (≥4.0) by sexual minority status, Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017

	UHR (95% CI)	AHR1[a] (95% CI)	AHR2[b] (95% CI)	AHR3[b] (95% CI)	AHR4[b] (95% CI)	AHR5[b] (95% CI)	AHR6[c] (95% CI)
Sexual orientation							
Sexual minorities (ref: heterosexuals)	1.43 (1.14, 1.80)	1.57 (1.20, 2.05)	1.20 (0.94, 1.54)	1.45 (1.11, 1.91)	1.21 (0.89, 1.65)	1.62 (1.26, 2.09)	1.11 (0.78, 1.58)
Underlying social characteristics							
Age (continuous)	1.10 (1.09, 1.10)	1.10 (1.09, 1.10)	1.10 (1.10, 1.11)	1.09 (1.08, 1.10)	1.10 (1.09, 1.11)	1.10 (1.09, 1.10)	1.09 (1.09, 1.10)
Urban residence (ref: non-urban)	0.82 (0.74, 0.90)	0.99 (0.89, 1.09)	0.91 (0.83, 1.01)	0.99 (0.89, 1.10)	0.93 (0.82, 1.05)	1.04 (0.94, 1.15)	0.91 (0.80, 1.04)
Women (ref: men)	0.52 (0.48, 0.57)	0.53 (0.48, 0.58)	0.52 (0.48, 0.58)	0.53 (0.48, 0.58)	0.47 (0.41, 0.53)	0.53 (0.49, 0.58)	0.47 (0.42, 0.53)
Race (ref: white)							
Aboriginal	1.33 (1.09, 1.62)	1.81 (1.48, 2.21)	1.68 (1.38, 2.05)	1.78 (1.48, 2.13)	1.32 (1.08, 1.62)	1.63 (1.38, 1.92)	1.26 (0.97, 1.62)
Other racialized minority	0.40 (0.32, 0.49)	0.56 (0.45, 0.70)	0.60 (0.47, 0.76)	0.58 (0.46, 0.73)	0.41 (0.30, 0.55)	0.57 (0.45, 0.73)	0.47 (0.33, 0.67)
Fundamental cause-related mediators							
Marital status (ref: married/partnered)							
Previously married	2.87 (2.56, 3.22)	–	2.14 (1.92, 2.39)	–	–	–	1.53 (1.35, 1.82)
Single	1.09 (0.98, 1.21)	–	2.25 (2.01, 2.52)	–	–	–	1.49 (1.29, 1.72)
Children (ref: none)	0.31 (0.28, 0.35)	–	–	0.65 (0.58, 0.73)	–	–	0.72 (0.59, 0.88)
Income (ref: lowest quintile)							
Second-lowest quintile	0.46 (0.39, 0.55)	–	–	–	0.45 (0.37, 0.53)	–	0.50 (0.42, 0.59)
Middle quintile	0.42 (0.35, 0.50)	–	–	–	0.37 (0.31, 0.43)	–	0.45 (0.37, 0.53)
Second-highest quintile	0.35 (0.30, 0.42)	–	–	–	0.29 (0.25, 0.34)	–	0.38 (0.32, 0.45)
Highest quintile	0.29 (0.25, 0.35)	–	–	–	0.20 (0.17, 0.24)	–	0.27 (0.22, 0.33)
Educational attainment (ref: <secondary)							
Secondary	0.48 (0.42, 0.55)	–	–	–	–	0.64 (0.56, 0.73)	0.85 (0.69, 1.04)
Some postsecondary	0.39 (0.32, 0.47)	–	–	–	–	0.60 (0.51, 0.71)	0.80 (0.63, 1.02)
Postsecondary grad	0.34 (0.31, 0.38)	–	–	–	–	0.46 (0.41, 0.51)	0.73 (0.61, 0.88)

Note. UHR = unadjusted hazard ratio; AHR = adjusted hazard ratio; ref = referent category.
[a] adjusted for underlying social characteristics.
[b] adjusted for one mediator (and underlying social characteristics).
[c] full model, adjusted for all mediators (and underlying social characteristics).

in the workplace legislation, access to marriage equality, etc., however, these laws and policies are clearly not sufficient in and of themselves (Krieger, 2020). More work is needed to evaluate other social policies and legislation that can improve access to life-affirming social and material resources (Carpenter et al., 2021). Long follow-up periods will be needed to examine the benefits of these kinds of structural interventions; however, ultimately these mediators—and associated structural interventions—may account for more of the relationship between sexual minority status and health outcomes (including mortality) than minority stress factors alone.

Author Statement

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Data availability

The authors do not have permission to share data.

Appendix A. Causes of death by preventability ratings, based on Phelan et al. (Erosheva et al., 2016), updated for Canadian context, 2000–2017

Preventability rating	ICD-10 code	Cause of death
1.0	C23	Malignant neoplasm of gallbladder
	C24.9	Malignant neoplasm of biliary tract, unspecified
2.0	C24.0	Malignant neoplasm of extrahepatic bile ducts
	C25	Malignant neoplasm of pancreas
	C73	Malignant neoplasm of thyroid gland
	C81.9	Hodgkin lymphoma, unspecified
	C85.1	Unspecified B-cell lymphoma
	D43.2	Neoplasm of uncertain behavior of brain, unspecified
	D47.1	Chronic myeloproliferative disease
	G12.2	Anterior horn cell disease
	G35	Multiple sclerosis
	G70/G71/G72	Myoneural disorders, muscular dystrophies, and other myopathies
	M34.8	Other forms of systemic sclerosis
2.5	C37/C38	Malignant neoplasm of thymus, heart and mediastinium
	C55/C56/C57.4	Malignant neoplasm of ovary and other uterine adnexa
	C71	Malignant neoplasm of brain
	C82.9/C83/C85.9/ C91.9	Lymphosarcoma and reticulosarcoma
	C88/C90	Multiple myeloma and immunoproliferative neoplasms
	C92	Myeloid leukemia
	C95	Leukemia of unspecified cell type
3.0	C15	Malignant neoplasm of esophagus
	C16	Malignant neoplasm of stomach
	C51.9	Malignant neoplasm of vulva, unspecified
	C54	Malignant neoplasm of body of uterus
	C64	Malignant neoplasm of kidney, except renal pelvis
	D46.9	Myelodysplastic syndrome, unspecified
	D61	Aplastic anemia
	D64.9	Anemia, unspecified
	D86	Sarcoidosis
	E88.0	Disorders of lipoid and plasma protein metabolism
	F19	Other psychoactive substance related disorders
	F03	Senile and presenile organic psychotic conditions
	G30.0	Alzheimer's disease with early onset
	G30.1	Alzheimer's disease with late onset
	G30.9	Alzheimer's disease, unspecified
	I42	Cardiomyopathy
	M30	Polyarteritis nodosa and allies conditions
	Q60-64	Congenital anomalies of urinary system
	X70, X80	Suicide and self-inflicted injury by hanging, strangulation, suffocation and jumping from high place
3.5	C22	Malignant neoplasm of liver and intrahepatic bile ducts
	C50	Malignant neoplasm of female breast
	C61	Malignant neoplasm of prostate
	C91	Lymphoid leukemia
	D33	Benign neoplasm of brain and other parts of nervous system
	D65-69	Coagulation defects
	G20	Parkinson's disease
	G40	Epilepsy
	I26.0	Acute pulmonary heart disease
	I27.9	Chronic pulmonary heart disease
	I3.50	Nonrheumatic aortic (valve) stenosis
	I38	Valvular heart disease, excluding that of rheumatic origin
	I49.9	Arrhythmias
	I71	Aortic aneurysm
	I80.2	Phlebitis and thrombophlebitis of other and unspecified deep vessels of lower extremities
	J84.1	Other interstitial pulmonary diseases with fibrosis
	N00–N08	Acute glomerulonephritis, nephrotic syndrome, chronic glomerulohephritis, and nephritis and neuropathy, not specified as acute or chronic
	R54	Age-related physical debility
	X30-X39	Accidents due to natural and environmental factors
	X71	Intentional self-harm by drowning and submersion
	X78	Intentional self-harm by sharp object
4.0	A40-41	Septicemia
	A04.7	Enterocolitis due to Clostridium difficile
	A99	Unspecified viral hemorrhagic fever
	C10,11,13	Malignant neoplasm of oropharynx, nasopharynx, hypopharynx
	C14.0	Malignant neoplasm of pharynx, unspecified
	C18	Malignant neoplasm of colon
	C19-21	Malignant neoplasm of rectum, rectosigmoid junction, and anus
	C26.0	Malignant neoplasm of intestinal tract, part unspecified
	C43-44	Malignant neoplasm of skin
	C67	Malignant neoplasm of bladder

(*continued*)

Preventability rating	ICD-10 code	Cause of death
	E10-14	Diabetes mellitus
	E785	Hyperlipidemia, unspecified
	F10.2	Dependence syndrome
	I20-25	Ischemic heart disease
	I26	Pulmonary embolism
	I27.2	Other secondary pulmonary hypertension
	I33	Acute and subacute endocarditis
	I34.0	Carcinoid syndrome
	I50	Congestive heart failure
	I51.7	Cardiomegaly
	I60-69	Cerebrovascular diseases
	J60-65	Pneumoconiosis due to external agents
	K56.6	Other and unspecified intestinal obstruction
	K63.1	Perforation of intestine (nontraumatic)
	K70-77	Liver abscess and sequelae of chronic liver disease
	K92.2	Gastrointestinal hemorrhage
	N18	Chronic renal failure
	Q20-28	Bulbus cordis anomalies and anomalies of cardiac septal closure, other congenital anomalies of heart and circulatory system
	V95	Accident to powered aircraft
	Y85-86	Late effects of accidental injury
4.5	C00-04,07,08	Malignant neoplasm of lip, tongue, major salivary glands, gum, floor of mouth
	C09.9	Malignant neoplasm of intestinal tract, part unspecified
	E65-68	Obesity and other hyperalimentation
	E86	Volume depletion
	F10.1	Alcohol abuse
	F10.2	Alcohol dependency syndrome
	G00	Bacterial meningitis
	I05-09	Rheumatic heart disease
	I10	Essential (primary) hypertension
	I11	Hypertensive heart disease
	I12	Hypertensive renal disease
	I13	Hypertensive heart and renal disease
	I48	Atrial fibrillation and flutter
	I70	Atherosclerosis
	J9-18	Pneumonia and influenza
	J43	Emphysema
	J47	Bronchiectasis
	K55.0	Acute vascular disorders of intestine
	K55.9	Anemia due to enzyme disorder, unspecified
	K70, K73-74	Chronic liver disease and cirrhosis
	N10,11,15.9	Infections of kidney
	V01-99	Motor vehicle traffic accidents
	W00-19	Accidental falls
	W65-84	Accidents caused by submersion, suffocation, and foreign bodies
	X60-69	Suicide and self-inflicted poisoning by liquid, solid, gas or vapor
	X73-75	Suicide and self-inflicted injury by firearms and explosives
	X85-Y09	Homicide
5.0	A15-19	Tuberculosis
	B15-19	Viral hepatitis
	B20-24	Human immunodeficiency virus (HIV) disease
	C32	Malignant neoplasm of larynx
	C33,34	Malignant neoplasm of trachea, bronchus, and lung
	C45.9	Mesothelioma, unspecified
	C53	Malignant neoplasm of cervix uteri
	E1,2,3.2,3.3,3.8,3.9	Acquired hypothyroidism
	J04, J06, J20, J21	Acute laryngitis and tracheitis, acute upper respiratory infections of multiple or unspecified sites, acute bronchitis and bronciolitis
	J44	Chronic obstructive pulmonary disease
	J69.0	Pneumonitis due to inhalation of food and vomit
	J80	Acute respiratory distress syndrome
	K25,27,28	Peptic ulcer
	K29	Gastritis and duodenitis
	K35	Acute appendicitis
	K45	Hernia of abdominal cavity
	K57	Diveticula of intestine
	K80	Cholelithiasis
	K83.0	Cholangitis
	N20	Calculus of the kidney and ureter
	N39.0	Urinary tract infection, site not specified
	V90-94	Water transport accidents
	X00-09	Accidents caused by fire and flames
	X40-49	Accidental poisoning
	Y10-34	Injury undetermined whether accidently or purposely inflicted
	Y40-84	Misadventures during surgical and medical care and medical procedures as the cause of abnormal reaction or later complication
	Y86	Other accidents

Appendix B. Sensitivity analyses of Cox proportional hazard ratios (HR) for high and low preventable mortality by sexual minority status, at varying preventability thresholds, Canadian Community Health Survey-Canadian Mortality Database cohort, Canada, 2003–2017

Cause of death	UHR (95% CI)
By preventability category	
High preventable (5.0)	1.68 (1.16, 2.45)
Low preventable (<5.0)	1.19 (0.94, 1.51)
High preventable (≥4.5)	1.55 (1.13, 2.13)
Low preventable (<4.5)	1.16 (0.89, 1.50)
High preventable (≥4.0) *	1.43 (1.14, 1.80)
Low preventable (<4.0) *	1.02 (0.69, 1.52)
High preventable (≥3.5)	1.39 (1.12, 1.74)
Low preventable (<3.5)	0.96 (0.58, 1.58)

Note. UHR = unadjusted hazard ratio comparing hazard of mortality for sexual minority as compared to heterosexual respondents.

*primary analysis, per Phelan et al. (Erosheva et al., 2016).

References

Badgett, M. L., Durso, L. E., & Schneebaum, A. (2013). *New patterns of poverty in the lesbian, gay, and bisexual community - williams InstituteWilliams institute*. https://williamsinstitute.law.ucla.edu/research/census-lgbt-demographics-studies/lgbt-poverty-update-june-2013/. (Accessed 15 November 2019).

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine, 51*, 843–857.

Bjorkenstam, C., Andersson, G., Dalman, C., Cochran, S., & Kosidou, K. (2016). Suicide in married couples in Sweden: Is the risk greater in same-sex couples? *European Journal of Epidemiology, 31*(7), 685–690.

Bränström, R., Hatzenbuehler, M. L., Pachankis, J. E., & Link, B. G. (2016). Sexual orientation disparities in preventable disease: A fundamental cause perspective. *American Journal of Public Health, 106*(6), 1109–1115. https://doi.org/10.2105/AJPH.2016.303051

Bränström, R., van der Star, A., & Pachankis, J. E. (2019). Untethered lives: Barriers to societal integration as predictors of the sexual orientation disparity in suicidality. *Social Psychiatry and Psychiatric Epidemiology*. https://doi.org/10.1007/s00127-019-01742-6

Brooks, V. R. (1981). *Minority stress and lesbian women*. Lanham, MD: Lexington Books.

Caceres, B. A., Brody, A., Luscombe, R. E., Primiano, J. E., Marusca, P., Sitts, E. M., & Chyun, D. (2017). A systematic review of cardiovascular disease in sexual minorities. *American Journal of Public Health, 107*(4), e13–e21. https://doi.org/10.2105/AJPH.2016.303630

Carpenter, C. S., Eppink, S. T., Gonzales, G., & McKay, T. (2021). Effects of access to legal same-sex marriage on marriage and health. *Journal of Policy Analysis and Management, 40*(2), 376–411. https://doi.org/10.1002/PAM.22286

Cochran, S. D., & Mays, V. M. (2011). Sexual orientation and mortality among US men aged 17 to 59 years: Results from the national health and nutrition examination survey III. *American Journal of Public Health, 101*, 1133–1138. https://doi.org/10.2105/AJPH.2010.300013

Cochran, S. D., & Mays, V. M. (2015). Mortality risks among persons reporting same-sex sexual partners: Evidence from the 2008 general social survey-national death index data set. *American Journal of Public Health, 105*(2), 358–364.

Erosheva, E. A., Kim, H. J., Emlet, C., & Fredriksen-Goldsen, K. I. (2016). Social networks of lesbian, gay, bisexual, and transgender older adults. *Research on Aging, 38*(1), 98–123. https://doi.org/10.1177/0164027515581859

Ferlatte, O., Hottes, T. S., Trussler, T., & Marchand, R. (2017). Disclosure of sexual orientation by gay and bisexual men in government-administered probability surveys. *LGBT Health, 4*(1), 68–71. https://doi.org/10.1089/lgbt.2016.0037

Frohlich, K. L., & Potvin, L. (2008). Transcending the known in public health practice: The inequality paradox: The population approach and vulnerable populations. *American Journal of Public Health, 98*(2), 216–221. https://doi.org/10.2105/AJPH.2007.114777

Frohlich, K. L., Ross, N., & Richmond, C. (2006). Health disparities in Canada today: Some evidence and a theoretical framework. *Health Policy, 79*(2–3), 132–143. https://doi.org/10.1016/j.healthpol.2005.12.010

Goldbach, J. T., Tanner-Smith, E. E., Bagwell, M., & Dunlap, S. (2014). Minority stress and substance use in sexual minority adolescents: A meta-analysis. *Prevention Science, 15*(3), 350–363. https://doi.org/10.1007/s11121-013-0393-7

Hatzenbuehler, M. L. (2009). How does sexual minority stigma "get under the skin"? A psychological mediation framework. *Psychological Bulletin, 135*, 707–730. https://doi.org/10.1037/a0016441

Hatzenbuehler, M. L., Phelan, J. C., & Link, B. G. (2013). Stigma as a fundamental cause of population health inequalities. *American Journal of Public Health, 103*(5), 813–821.

Hottes, T. S., Bogaert, L., Rhodes, A. E., Brennan, D. J., & Gesink, D. (2016). Lifetime prevalence of suicide attempts among sexual minority adults by study sampling strategies: A systematic review and meta-analysis. *American Journal of Public Health, 106*(5), 921. https://doi.org/10.2105/AJPH.2016.303088

Hottes, T. S., Ferlatte, O., & Gesink, D. (2015). Suicide and HIV as leading causes of death among gay and bisexual men: A comparison of estimated mortality and published research. *Critical Public Health, 25*(5), 513–526. https://doi.org/10.1080/09581596.2014.946887

Juster, R. P., Hatzenbuehler, M. L., Mendrek, A., Pfaus, J. G., Smith, M. G., Johnson, P. J., … Pruessner, J. C. (2015). Sexual orientation modulates endocrine stress reactivity. *Biological Psychiatry, 77*(7), 668–676. https://doi.org/10.1016/j.biopsych.2014.08.013

Katz-Wise, S. L., & Hyde, J. S. (2012). Victimization experiences of lesbian, gay, and bisexual individuals: A meta-analysis. *The Journal of Sex Research, 49*, 142–167. https://doi.org/10.1080/00224499.2011.637247

Kim, H. J., Fredriksen-Goldsen, K. I., Bryan, A. E. B., & Muraco, A. (2017). Social network types and mental health among LGBT older adults. *The Gerontologist, 57*, S84–S94. https://doi.org/10.1093/geront/gnw169

Krieger, N. (2020). Measures of racism, sexism, heterosexism, and gender binarism for health equity research: From structural injustice to embodied harm—an ecosocial analysis. *Annual Review of Public Health, 41*(1). https://doi.org/10.1146/annurev-publhealth-040119-094017. annurev-publhealth-040119-094017.

Lick, D. J., Durso, L. E., & Johnson, K. L. (2013). Minority stress and physical health among sexual minorities. *Perspectives on Psychological Science, 8*(5), 521–548. https://doi.org/10.1177/1745691613497965

Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. Spec No *Journal of Health and Social Behavior*, 80–94.

Mathy, R. M., Cochran, S. D., Olsen, J., & Mays, V. M. (2011). The association between relationship markers of sexual orientation and suicide: Denmark, 1990-2001. *Social Psychiatry, 46*(2), 111–117. https://doi.org/10.1007/s00127-009-0177-3

Mayer, K. H., Bekker, L.-G., Stall, R., Grulich, A. E., Colfax, G., & Lama, J. R. (2012). Comprehensive clinical care for men who have sex with men: An integrated approach. *Lancet, 380*(9839), 378–387.

Meads, C., Martin, A., Grierson, J., & Varney, J. (2018). Systematic review and meta-analysis of diabetes mellitus, cardiovascular and respiratory condition epidemiology in sexual minority women. *BMJ Open, 8*(4). https://doi.org/10.1136/BMJOPEN-2017-020776

Meyer, I. H. (2003). Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations; conceptual issues and research evidence. *Psychological Bulletin, 129*, 674–697. https://doi.org/10.1037/0033-2909.129.5.674

Neophytou, A. M., Kioumourtzoglou, M. A., Goin, D. E., Darwin, K. C., & Casey, J. A. (2021). Educational note: Addressing special cases of bias that frequently occur in perinatal epidemiology. *International Journal of Epidemiology, 50*(1). https://doi.org/10.1093/ije/dyaa252

Neville, S., & Henrickson, M. (2006). Perceptions of lesbian, gay and bisexual people of primary healthcare services. *Journal of Advanced Nursing, 55*(4), 407–415.

Phelan, J. C., Link, B. G., Diez-Roux, A., Kawachi, I., & Levin, B. (2004). Fundamental causes" of social inequalities in mortality: A test of the theory. *Journal of Health and Social Behavior, 45*(3), 265–285. https://doi.org/10.1177/002214650404500303

Purcell, D. W., Johnson, C. H., Lansky, A., Prejean, J., Stein, R., Denning, P., … Crepaz, N. (2012). Estimating the population size of men who have sex with men in the United States to obtain HIV and syphilis rates. *The Open AIDS Journal, 6*, 98–107. https://doi.org/10.2174/1874613601206010098

Rich, A. J., Salway, T., Scheim, A., & Poteat, T. (2020). Sexual minority stress theory: Remembering and honoring the work of Virginia Brooks. *LGBT Health, 7*(3), 124–127. https://doi.org/10.1089/lgbt.2019.0223

Ross, L. E., Salway, T., Tarasoff, L. A., MacKay, J. M., Hawkins, B. W., & Fehr, C. P. (2018). Prevalence of depression and anxiety among bisexual people compared to gay, lesbian, and heterosexual individuals: A systematic review and meta-analysis. *The Journal of Sex Research, 55*(4–5). https://doi.org/10.1080/00224499.2017.1387755

Rutstein, D. D., Berenberg, W., Chalmers, T. C., Child, C. C., Fishman, A. P., & Perrin, E. B. (1976). Measuring the quality of medical care: A clinical method. *New England Journal of Medicine, 294*, 582–588.

Sanmartin, C., Decady, Y., Trudeau, R., Dasylva, A., Tjepkema, M., Finès, P., … Manuel, D. G. (2016). Linking the Canadian community health survey and the Canadian mortality database: An enhanced data source for the study of mortality. *Heal Reports, 27*(12), 10–18. http://www.statcan.gc.ca/pub/82-003-x/2016012/article/14687-eng.htm.

Sibley, L. M., & Glazier, R. H. (2009). Reasons for self-reported unmet healthcare needs in Canada: A population-based provincial comparison. *Healthcare Policy, 5*(1), 87–101. https://doi.org/10.12927/hcpol.2009.20934

Tjepkema, M. (2008). Health care use among gay, lesbian and bisexual Canadians. *Heal reports, 19*(1), 53–64. http://www.statcan.gc.ca/pub/82-003-x/2008001/article/10532-eng.htm.

Tjepkema, M., Wilkins, R., & Long, A. (2013). Cause-specific mortality by income adequacy in Canada: A 16-year follow-up study. *Health Reports, 24*(7), 14–22.